

Modeling High-temperature Creep Behavior of EUROFER 97 Steel

Sandhyaa Jeyaseelan, Yi Zhang, Jing Zhang

Department of Mechanical Engineering, Indiana University – Purdue University Indianapolis

The objective of the study is to develop a thermal creep analysis model for EUROFER 97 reduced activation ferritic/martensitic (RAFM) steel used in nuclear applications. The simulation was carried out using ANSYS for comparison with the experimental data. Creep is a time-dependent visco-elastoplastic phenomenon that is heavily dependent on temperature. In this model, the Norton Law was used to predict the creep rupture.

The sample under study is a cylindrical specimen subjected to axial tensile pressure. Quarter axisymmetric model was used for ease of modeling and calculation. Structural solid model with fine mesh and linear isotropic properties was defined. Non-linear implicit creep model was defined using the Norton Law which considers secondary (steady-state) creep. Time and temperature parameters were considered in this simulation (650°C for 80,000 seconds) since creep is heavily dependent on time and temperature effects when the diffusivity, vacancy and dislocation mobility are activated. Upon solving, contour plots of creep strain and von Mises stress distribution before and after the creep effect were obtained. The ANSYS simulation data matched the experimental creep stress and strain values. The ANSYS creep simulation capabilities thus modeled, can be extended to other specimen and materials of interest.